Evaluating the Implementation Barriers of an Intranasal Fentanyl Pain Pathway for Pediatric Long-Bone Fractures

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Objectives: This study aimed to assess physician comfort, knowledge, and implementation barriers regarding the use of intranasal fentanyl (INF) for pain management in patients with long-bone fractures in a pediatric emergency department (ED) with an INF pain pathway.

Methods: A retrospective chart review was conducted of patients, 3 to 21 years old, in our ED with an International Classification of Diseases-9th Revision code for a long-bone fracture from September 1, 2013, to August 31, 2015. Patients were divided into 4 groups: (1) received INF on the pathway appropriately; (2) “missed opportunities” to receive INF, defined as either INF was ordered and then subsequently canceled (for pain ratings, ≥6/10), or INF was ordered, cancelled, and intravenous (IV) morphine given, or INF was not ordered and a peripheral IV line was placed to give IV morphine as first-line medication; (3) peripheral IV established upon ED arrival; (4) no pain medication required. Additionally, a survey regarding practice habits for pain management was completed to evaluate physician barriers to utilization of the pathway.

Results: A total of 1374 patients met the inclusion criteria. Missed opportunities were identified 41% of the time. Neither younger patient age nor more years of physician experience in the ED were associated with increased rates of missed opportunities. The survey (95% response rate) revealed greater comfort with and preference for IV morphine over INF.

Conclusions: The high rate of missed opportunities, despite the implementation of an INF pain pathway, indicates the need for further exploration of the barriers to utilization of the INF pain pathway.

Key Words: intranasal, fentanyl, pain, morphine, physician

(Pediatr Emer Care 2017;00: 00–00)

Pain is the most common presenting symptom in the emergency department (ED), and pain management in the pediatric population is often suboptimal.1,2 Pain control in pediatric patients with orthopedic trauma in the ED is often undertreated.3,4 Providing a more efficient solution to pain relief in the setting of pediatric orthopedic trauma is a priority recognized by the American Academy of Pediatrics in their policy statement on eliminating pain-associated suffering within the medical setting.5 Despite this policy, barriers to adequate pain management in pediatrics persist, including a fear of prescribing opioids to children, lack of formal training regarding opioid medication choice, fear of causing adverse drug reactions, difficulty of communicating pain levels by pediatric patients, and provider discomfort ordering opioids for children.6–9

Although intravenous (IV) morphine is fast and effective, peripheral IV (PIT) placement can be challenging in the pediatric population.10 Peripheral intravenous placement has also been well described as one of the most painful and anxiety-provoking experiences in a patient’s ED visit.11,12 Intranasal (IN) fentanyl has been proven to be equally effective as IV morphine for rapid pain relief of pediatric long-bone fractures (LBFs).13 Intranasal fentanyl also enables a faster, less invasive method of pain medication delivery, because no PIV placement is needed.8,14,15 Multiple studies have described the benefits of using IN fentanyl for pain management in the ED setting.14,15 However, studies have shown that the translation of research-based evidence into clinical practice takes an average of 17 years.16 The Institute for Healthcare Improvement highlights this knowledge translation as a key barrier to effective health care improvement. The use of IN fentanyl for pain management in the pediatric ED has been slower than expected, with many ED providers still focusing on IV opioid treatment as first-line therapy.17–19 To our knowledge, there is no current literature describing pediatric ED physician barriers to using IN fentanyl.20,21

In 2011, the Children’s Hospital of The King’s Daughters Emergency Department (CHKD-ED) implemented an IN fentanyl pain clinical pathway for LBFs and demonstrated that the utilization of the pathway significantly decreased time to pain medication administration and demonstrated equal efficacy as IV morphine.18 In the year after the implementation of this new pathway (Appendix 1, http://links.lww.com/PEC/A225), we anecdotally noted significant underuse of IN fentanyl for patients with suspected diagnoses of LBFs who did not have IV access. This study aims to assess physician comfort, knowledge, and implementation barriers regarding the use of parenteral opioids for pain management in a pediatric ED. We hypothesized that years of experience in the pediatric ED setting will be inversely correlated with IN fentanyl use for pediatric LBFs, as more years in practice as a physician has been associated with slower adoption of new practices.20–23 Furthermore, we hypothesized that younger patient ages would receive IN fentanyl less frequently, because younger age has been described as a barrier for using opioids in other pediatric studies.24–27

METHODS

Study Design and Setting

We conducted a retrospective chart review in the ED of an urban academic children’s hospital that sees approximately 50,000 patient visits per year. Additionally, an anonymous electronic survey was administered to physicians working in the CHKD-ED. This study was approved by our institutional review board.

Selection of Participants

We performed a chart review of all patients between 3 and 21 years of age (to correspond with the ages eligible for placement on our IN fentanyl pain pathway), presenting to the CHKD-ED with an International Classification of Diseases-9th Revision code for a...
LBF, from September 1, 2013, to August 31, 2015. We invited all physicians working in the pediatric ED to complete a voluntary, anonymous survey. Survey participants included pediatric emergency medicine physicians, pediatric emergency medicine fellows, and general pediatricians whose primary clinical practice was in the ED at the time we sent out the survey in February 2016.

Methods and Measurements

The medical record numbers of the patients that met inclusion criteria were consolidated in an excel worksheet. The following data were collected in the chart review: patient age, visit date, triage pain score, presence or absence of IV access on ED arrival, receipt of opioids in the ED, initial attending physician assigned to the patient, and whether IN fentanyl was ordered and received as a first-line medication. Patients were categorized into 4 groups based on the intervention they received in the CHKD-ED: group 1, those who received IN fentanyl on the pain pathway appropriately; group 2, those who were considered a missed opportunity to receive IN fentanyl, defined as either IN fentanyl was ordered and then subsequently canceled on a patient with an initial pain score of ≥6 (moderate),27 or IN fentanyl was ordered and then subsequently canceled on a patient who had an IV placed and was given IV morphine, or IN fentanyl was not ordered in a patient who had an IV placed and was given IV morphine, or IN fentanyl was not ordered in a patient who had an initial pain score of ≥6; group 3, those who already had a PIV established upon ED arrival; group 4, those who did not require any pain medication or only received oral pain medication. Patients were also categorized by age into a younger group (<8 years) and an older group (≥8 years). Eight years was used as the cutoff point between the 2 groups because it is the age of assay in our pediatric ED and as required by our institutional review board.

The number of years of experience working in the ED setting was determined with administrative data from curriculum vitae of division members. We calculated the number of years of experience as the difference between the date from when the survey was distributed and the provider’s start time working in the ED setting. The start time of working in the ED setting was either the start of their pediatric emergency medicine fellowship (for pediatric ED attendings or fellows), or the start of their time working in the ED (for the general pediatricians), all of whom began working in the ED within a few months of completion of pediatric residency. Physicians were categorized into 1 group with less than 10 years of experience and a second group with more than 10 years of experience. We chose 10 years because this number divided our division members equally between 13 junior faculty with less than 10 years of experience and 13 senior faculty with more than 10 years of experience.

Survey

To ensure face validity, a survey was developed by a board-certified pediatric emergency medicine physician, an emergency medicine physician at an outside institution, and a biostatistician skilled in survey design. Survey question content focused on two primary areas: determining provider preference and comfort using IN fentanyl compared to IV morphine in the management of LBFs, and provider knowledge regarding current evidence-based guidelines for pain management in patients with LBFs. The survey was pilot tested on a board-certified pediatric emergency medicine physician, a medical student and a nonmedical employee. Modifications to survey wording were made to improve the clarity of the wording of survey questions (Appendix 2, http://links.lww.com/PEC/A226). Participants consented to participation before survey completion. The survey was anonymous and no identifying information about survey respondents was collected. The survey question formats included multiple choice questions, free response, and Likert scale questions. Each survey participant received access to an online survey via Survey Monkey according to a modified Dillman methodology,28 which included an initial e-mail invitation with subsequent reminders at 1 and 3 weeks after the initial invitation. One week after the second reminder invitation, the survey closed.

Outcomes

Our primary hypothesis was that the number of years of physician experience in the pediatric ED setting would be inversely correlated with the proportion of appropriate IN fentanyl use for pediatric LBFs. This proportion is the number of patients who should have received IN fentanyl (group 1) divided by the sum of both the number of those who should have received IN fentanyl (group 1) and those who were missed opportunities (group 2). For our secondary outcome, we hypothesized that younger patients (<8 years) would receive appropriate IN fentanyl usage less frequently than older patients (≥8 years). We also studied whether the proportion of patients with appropriate IN fentanyl use changed over the course of the study period. Both the primary and secondary outcomes were based on the medical record review. The survey results were compared with the practices identified by the medical record review.

Analysis

For our primary outcome, a Generalized Linear Model was used to estimate the correlation between providers’ experience and proportion of appropriate IN fentanyl usage.29 For our secondary outcome, a χ² test was done to determine whether younger patients (<8 years) received IN fentanyl less frequently than older patients (≥8 years).

We used statistical process control methodology (p-chart) to determine whether the process was stable over time.30 The p-chart rules for special cause variation included a point outside of the control limits (set at 3 standard deviations), 9 points in a row on the same side of the center line, and 6 points in a row all increasing or decreasing.31

Each survey question was analyzed using standard descriptive statistics to determine the percent of respondents who fell into each category provided in the question. In addition, we compared results for pediatric emergency medicine physicians, general pediatricians and pediatric emergency medicine fellows. Data were analyzed using SAS 9.4 software (Cary, N.C.) and Minitab (v17.0, State College, Pa).

RESULTS

A total of 1374 patients met the inclusion criteria for LBF between September 1, 2013, and August 31, 2015. The median age was 8 (interquartile range, 5–12) (Fig. 1). The percentage of patients in groups 1, 2, 3, and 4 were 16% (n = 218), 11% (n = 152), 28% (n = 380), and 45% (n = 624), respectively.

For our primary outcome, the number of years of physician experience in the pediatric ED was not inversely correlated with the proportion of IN fentanyl use for pediatric LBF patients (odds ratio, 1.00; 95% confidence interval [CI], 0.97–1.03; P = 0.74). For our secondary outcome, younger aged patients received IN fentanyl just as frequently as older patients (OR, 1.45; 95% CI, 0.95–2.20; P = 0.09) (Fig. 2). Of the patients with an opportunity to appropriately use IN fentanyl per our pathway, there was a 41% rate of missed opportunities (Fig. 3). This proportion was stable over the course of the study on our statistical process control chart with no special cause variation (Fig. 3).
Nineteen (95%) of 20 physicians meeting inclusion criteria responded to the survey. Respondents included twelve pediatric emergency medicine physicians (median number of years after pediatric residency, 15.5; range, 6–36), 4 pediatric emergency medicine fellows, and 3 general pediatricians practicing in the ED (number of years after residency, 6, 11, and 16 years) participated in the survey (Appendix 2, http://links.lww.com/PEC/A226). All providers surveyed had been involved in the care of a child with a LBF in the last 18 months. Six of 26 physicians who had been included in the primary outcome analysis did not meet inclusion criteria for the survey, because they were no longer working in the ED because of graduation from fellowship or alternative job placement.

Per our survey results, providers were more comfortable using morphine in LBFs than IN fentanyl (Fig. 4) \((P = 0.002)\). The majority (58%) of providers preferred using IV morphine instead of IN fentanyl. There was no significant difference in the surveyed preference for IV morphine instead of IN fentanyl, between physicians with less than 10 years of experience (50% preference for fentanyl) and those with greater than 10 years of experience (36% preference) \((-13\% \text{ difference}; 95\% \text{ CI}, -58\% \text{ to } 31\%; P = 0.55)\).

Among Pediatric Emergency Medicine boarded physicians \((N = 12)\), there was equal preference between IN fentanyl and IV morphine. Pediatric EM fellows \((N = 4)\) also had equal preference between IN fentanyl and IV morphine. All of the general pediatricians \((N = 3)\) practicing in the CHKD-ED preferred using morphine over IN fentanyl. Of the 16 (84%) providers who had never used IN fentanyl as first-line therapy before working in our ED, their mean comfort level with using IN fentanyl for pain management in patients with LBFs was not significantly different than those providers \((n = 3)\) who had used IN fentanyl as first-line therapy before working in the CHKD-ED (median 8.5 vs 9, \(P = 0.71)\).

Fifty-eight percent \((n = 11)\) of providers did not feel that patient age was a barrier to physicians treating LBFs with IN fentanyl. Twenty-one percent \((n = 4)\) felt that patient age was a barrier, whereas 21\% \((n = 4)\) were unsure whether patient age was a barrier. The median of the youngest age that survey respondents were willing to administer IN fentanyl was 18 months (interquartile range, 12–24 months; range, 0–36 months). Among physicians who used IN fentanyl frequently (ie, answered yes to question 9), 50\% (8/16) of physicians correctly answered the knowledge-based question (question 14). Among physicians who did not use IN fentanyl frequently, 0\% (0/3) of the physicians answered the knowledge-based question correctly (50% difference; 95% CI, 26–74\%; \(P < 0.001)\).

When the IN fentanyl pathway was ordered by a resident or nurse practitioner, before attending physician assessment of
the patient, forty-seven percent (n = 9) of physicians reported discontinuing a patient from the IN fentanyl pathway with the intent of using a different analgesic. Twenty-one percent (n = 4) of physicians reported having discontinued a patient from the pathway started by another provider. Thirty-two percent (n = 6) of physicians were unsure whether they had discontinued a patient from the pathway. Reasons given for discontinuing the pathway were: IV access was already in place on arrival to ED (cited by 8 physicians) and personal lack of experience and comfort with IN fentanyl (cited by 1 physician). The free text responses for why IN fentanyl was not used included the following: “[IN fentanyl] did not appear to work with (a) crying child,” “[it is] just as fast to get a line and morphine and we already know they’re going to need the line,” and that “[the team was] placing IV for sedation or admission, so I changed to IV pain meds.”

**DISCUSSION**

Despite the implementation of an IN fentanyl clinical pain pathway, there were still frequent missed opportunities for the utilization of IN fentanyl for pediatric LBFs in our ED. The number of missed opportunities remained consistent over the 2-year period that data were analyzed (Fig. 3). Other studies on this topic have not used the concept of missed opportunities, and our findings represent a novel addition to the field of pediatric IN fentanyl use in the ED.

We found that equal preference between IN fentanyl and IV morphine among surveyed providers with less than and greater than 10 years of experience. This finding correlated accurately with actual provider prescribing practices in the CHKD-ED. This indicates that provider survey responses are in line with their practice behavior, thus increasing the reliability of our survey data. However, our hypothesis regarding provider years of experience in the pediatric ED being inversely correlated with the degree of appropriate IN fentanyl use was incorrect because there was no correlation between provider years of experience and missed opportunities to use the IN fentanyl pathway appropriately. To our knowledge, there are no other studies that have looked into provider experience and IN fentanyl prescription practice.

Our study found that providers do not view age as a barrier to administering opioid pain medication to a pediatric population. This finding is in contrast to a few survey and practice studies in the pediatric pain literature. One possible explanation for this
Our study found that the barriers to the usage of the IN fentanyl pain pathway included greater physician comfort and preference for IV morphine compared with IN fentanyl, personal lack of experience with IN fentanyl, the perception that IN fentanyl is not as effective as IV morphine in treating pain, the perception that IN fentanyl takes an equal amount of time to administer as IV morphine, and the notion that IN fentanyl is not necessary if an IV is being placed for a reason other than pain medication. The implementation science literature cites multiple reasons why physicians are slow to adapt evidence-based pathways, many of which might have contributed to our low rate of IN fentanyl usage and high rate of missed opportunities to prescribe IN fentanyl appropriately. The characteristics of an evidence-based pathway and the timeline over which it is introduced are important factors to consider when determining reasons for low rates of adoption. However, physician-related barriers to adapting evidence-based pathways can be divided into the following categories: knowledge-based, attitude-based, and behavior-based.

Knowledge-related barriers stem from a lack of awareness and familiarity with a clinical pathway. Physicians have to effectively unlearn outdated pathways in favor of new ones, which takes time and concerted effort on the part of the physician. Attitude-based barriers, such as general guideline disagreement, lack of self-efficacy and outcome expectancy, and inertia from previous methods of practice, are significant contributors to the adaption of evidence-based practices, barriers from other ED team members (eg, nursing buy-in) can also impact the implementation of new clinical practices. This study was not designed to study the impact of these nonphysician members of the ED team.

At our institution, our providers were less comfortable using IN fentanyl than morphine despite the fact that 50% of providers who use IN fentanyl frequently demonstrated an understanding of the current evidence regarding IN fentanyl found in the literature. Further evaluation of provider perspectives is necessary to understand this gap between clinical knowledge and clinical practice. We found that physicians who correctly answered the knowledge question (question 14) had a higher level of comfort using IN fentanyl than physicians who incorrectly answered the knowledge question. Because increased knowledge was associated with increased comfort, which was subsequently associated with a higher rate of IN fentanyl usage in practice, it suggests that improving provider knowledge might be a critical first step to improving IN fentanyl utilization. The discrepancy in IN fentanyl pathway utilization between pediatric emergency medicine-trained and non–pediatric emergency medicine-trained physicians represents another opportunity to educate specific providers and potentially increase utilization of the IN fentanyl pain pathway.

Our definition of a missed opportunity for IN fentanyl use and our method of tracking it over time could be generalizable as a quality measure for LBF pathways, or other clinical pathways, in other EDs. We believe that the generation of this measure supports the American Academy of Pediatrics’ goal of decreasing pain-associated suffering within the medical setting. Generalizing the use of our definition of missed opportunity could help other pediatric EDs identify individualized ways of reducing pain in patients with LBFs.

Limitations

One limitation of our study is single-center design of our study. However, the large number of included fracture patients and age distribution enhances the credibility of our findings. Another limitation is the sample size of providers surveyed; however, our high survey response rate of 95% indicates that our findings capture the perceptions of the vast majority of our practicing providers. Though our study provides insight into provider preferences that may affect the utilization of the IN fentanyl clinical pain pathway at our institution, the barriers we noted might not be generalizable to other institutions. The use of pain scores as an indirect measure to assess for the need for pain medication in pediatric emergency care is complicated. Our institution’s use of 10 point pain scales does not capture the patient’s preference for pain medication. We used ≥6/10 pain as a threshold for moderate pain to capture most patients who could have benefited from opioid pain medication without overestimating the benefits of opioids for those patients with milder pain assessments. Additionally, pediatric pain scores and pain score reassessments are not recorded with regularity, making their use and reliability challenging in pediatric studies.

CONCLUSIONS

This study demonstrated that despite the implementation of a clinical IN fentanyl pain pathway, our pediatric ED continued to have frequent missed opportunities to administer IN fentanyl. The high rate of missed opportunities to use IN fentanyl in patients with LBFs over the course of 2 years demonstrates the continued need to address barriers to utilization of IN fentanyl. The physician perspective at our institution demonstrated increased preference and comfort with using IV morphine over IN fentanyl despite demonstrated knowledge of pain management guidelines. We are planning iterative trials to test future interventions to increase the utilization of the IN fentanyl pain pathway.

REFERENCES


